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RF/RMRS-98-208

ALARA JOB REVIEW
for
INDIVIDUAL HAZARDOUS SUBSTANCE SITE (IHSS) 108
TRENCH 1 (T-1) SOURCE REMOVAL PROJECT
Revision 0

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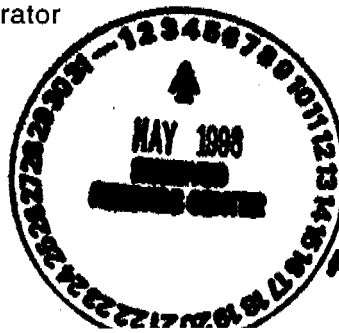
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1.0 THE ALARA EVALUATION PROCESS

Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection (10 CFR 835) requires an emphasis on As Low As Reasonably Achievable (ALARA) implementation at all DOE sites. Consistent with this regulation, Article 312 of the Site Radiological Control Manual (RCM) requires a formal radiological review of non-routine and complex work activities when the potential to exceed established trigger levels exists in order to ensure safety and maintain radiation exposures ALARA. The trigger levels required by the RCM are contained in 94-ALARA PLAN-0003, "ALARA Program Plan". The Excavation of Trench-1 has the potential to meet the following ALARA trigger points; removable contamination is expected to exceed 100 times the limits of Table 2-2 of the RCM, and a potential release to the environment exists. This ALARA Job Review formally delineates the radiological requirements for the project.

Radiological Engineering Procedure (REP) 1002, "ALARA JOB REVIEW", provides instructions for performing ALARA Job Reviews. The ALARA Job Review typically consists of four major parts: (1) Task Description; (2) Radiological Concerns; (3) Options Considered; and (4) Controls to be implemented. In addition, an ALARA Person-Rem estimate is required if a dose-related trigger point is met; a Person-Rem Estimate is not required for the T-1 Excavation Project. The ALARA Job Review may also include dose calculations, bioassay plans, and any other information which was used to develop the formal review.

The ALARA Job Review shall be used to develop Radiological Work Permits (RWPs) as well as the other applicable plans and procedures to ensure that the radiological requirements are incorporated. The RWPs governing the Trench-1 Project will reference this ALARA Job Review, as applicable, and will require Radiological Engineering concurrence.

2.0 PROJECT DESCRIPTION

T-1 is located just northwest of the inner east gate, and about 40 feet south of the southeast corner of the Protected Area (PA) fence (Attachment 1). The trench is approximately 250 feet long, 16 to 22 feet wide, and 10 feet deep. Historical documentation indicates depleted uranium metal chips (lathe and machine turnings) packed in lathe coolant were buried in the west end of T-1 in approximately 125 drums. The drums were reportedly double stacked end-on-end in the trench and covered with one to two feet of soil. No written documentation exists for the contents of the center and east end of the trench. Interviews with former site workers indicate that the eastern two-thirds of the trench is likely to contain trash (pallets, paper) and debris such as empty or crushed drums.

Under the proposed action, reference *Final Proposed Action Memorandum for the Source Removal at Trench 1 IHSS 108*, the drums of depleted uranium chips and incidental contaminated soils will be excavated and treated to stabilize the potentially pyrophoric nature of the uranium chips. Soils with high levels of depleted uranium, (exceeding RFCA Tier I action levels) will also be excavated and stabilized, as required. The stabilized chips and contaminated soils will be packaged and shipped off-site for treatment and subsequent disposition.

2.1 Background

Drums of waste from Building 444 were first placed in T-1 in November 1954 and burial operations continued intermittently until December 1962. Wastes were initially buried in T-1 when Building 444 could not safely process drums of depleted uranium turnings that were combustible and presented a pyrophoric hazard. The pyrophoric nature of this waste made transporting the depleted uranium (often called tuballoy or D-38) a safety hazard. The depleted uranium chips were in drums which also contained lathe coolant (primarily a mixture of water, mineral oil, fatty amides), dirt and other foreign material. Historical information indicates other wastes are buried in T-1 from Building 444 including ten drums of cemented cyanide, one drum of "still bottoms" and "copper alloy." The east end of the trench is expected to contain crushed drums, broken pallets, debris and trash.

The depleted uranium casting and machining began in Building 444 in 1953. The production operations in Building 444 were conducted to support war reserve, special order and manufacturing development work. Weapons components were fabricated from various materials such as depleted uranium, beryllium, stainless steel, and aluminum. Operations in Building 444 included casting, fabrication, assembly, inspection and testing, coating and heat treating, plating, special projects and support operations. Machining operations included turning, facing, boring, milling, and sawing of the above materials using lathes, saws, milling equipment and other conventional machine tools. In 1956 the chip roaster began operation in Building 447 to roast depleted uranium chips from the machining processes conducted in Building 444. The roaster was out of service from 1959 to 1961. The waste depleted uranium chips in lathe coolant, dirt, and floor sweepings were stored on the Building 444 dock before the roaster became operational and during the roaster shutdown period. It was during these periods that wastes from Building 444 went to T-1.

2.2 Existing Conditions

The T-1 area was investigated during the Operable Unit 2 Phase II Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation. Additional characterization was conducted as part of the 1995 Trenches and Mound Site investigation. Due to the suspected presence of pyrophoric uranium and its associated hazards, no drilling or subsurface sampling was performed inside of the T-1 boundaries.

The T-1 area was investigated in 1995 using the following methodologies:

- Historical data were compiled using the Historical Release Report (HRR) and supplemented with employee (i.e., current, former, and retired employees) interviews to identify buried materials, potential contaminants, trench location, and trench size.
- Aerial photographs were examined to identify disturbed areas, verify trench dimensions and location, and determine time of operation.
- A site visual survey was performed to identify physical features and establish a geophysical sampling grid.
- Electromagnetic and Ground Penetrating Radar surveys were conducted to locate buried conductive and/or metallic objects and define trench boundaries.
- Soil gas surveys were conducted to identify and delineate potential contaminant plumes.

Historical records and information obtained through employee interviews indicate that 125, 30-gallon and 55-gallon steel drums containing 10,000-20,000 kilograms of depleted uranium chips and turnings, and miscellaneous debris were disposed in T-1. Drum inventory lists, memoranda, and drum shipping logs documenting the placement of 85 drums in T-1 have been located. The inventory lists and former employee interviews indicate that the depleted uranium waste disposed in T-1 originated from Building 444. The uranium chips and turnings were coated with a water-soluble lathe coolant (trade name CimCool) during machining of parts. The inventory records also include ten drums of cemented cyanide waste from Building 444. Cyanide and cadmium wastes are known to have been generated during metallurgical operations in Building 444.

A pilot-scale 55-gallon drum evaporator was reportedly used in Building 444 for reducing machine coolant oil waste volume. The resulting condensate was transferred to the process waste treatment system in Building 774, and the "still bottoms" were "drummed and buried through normal disposal channels". "Still bottoms" from Building 444 could potentially consist of either the lathe coolant sludge discussed above or still bottoms from the recovery of residual trichloroethene and perchloroethene waste solvents and sludge generated from machined parts cleaning.

Several of the drums containing depleted uranium and lathe coolant oil are described in historical documents as 30-gallon drums placed inside 55-gallon drums and then over packed with graphite. The graphite is believed to have been excess material derived from waste graphite molds utilized during production operations in Building 444.

Personnel directly involved in the trench disposal activities stated that the buried 30- and 55-gallon drums were generally double-stacked in the trench on-end (vertically), in rows of 4 to 5 drums across. The trench is estimated to be approximately 10 feet deep, 15 feet wide, and 250 feet long. This correlates well with investigation results. The bulk of the drums containing depleted uranium were reportedly disposed in the west portion of the trench from 1954 to 1962. Individual groups of drums were reportedly completely covered with one to two feet of soil immediately after placement in the west end of T-1. Miscellaneous debris was placed mostly in the central and eastern portions of the trench until the trench was closed in 1962. The drums and debris were covered with one to two feet of soil.

Weed cutting activities in October and November, 1982 unearthed two drums not adequately covered with fill material. Both drums were sampled and the liquids were transferred to Waste Processing for disposal. One drum is documented to have contained an oil/water mixture which yielded plutonium analyses of 55 picocuries per liter (pCi/l) and uranium analyses of 2.3×10^5 pCi/l. The other drum is documented as having contained an oily sludge which yielded results of 4.3 pCi/g plutonium and 1.2×10^6 pCi/g uranium.

Based on this information, conflicting data exists regarding the potential contaminants in the trench. All references that mention the origin of the waste confirm that it was from Building 444 exclusively. It is believed from interviews with retired Rocky Flats employees and the HRR that Building 444 processed uranium and not plutonium; yet, several references state that analytical results from the two drums uncovered in 1982 indicated the presence of low levels of plutonium.

2.3 Scope

The Trench-1 source removal entails excavating approximately 125 drums of depleted uranium (DU) and stabilizing the potentially pyrophoric DU materials. An estimated 1000 to 1500 cubic yards of associated radiologically contaminated soils, debris and other drummed wastes also located within the trench will be excavated and treated if necessary on site.

Consistent with the Activity Control Envelope (ACE) Document, this ALARA Job Review (AJR) only considers excavation, segregation, and inerting/packaging. Treatment of materials will occur at an off-site facility and, therefore, is beyond the scope of the ACE Document and AJR.

The ground breaking activities are expected to commence in May of 1998 and continue through to October of 1998.

2.4 Tasks

Major activities that will be performed as part of the T-1 Project that are relevant to this ALARA Job Review are, excavation, staging/segregation of contaminated materials and soil and inerting the depleted uranium.

2.4.1 Excavation

Conventional excavation techniques will be used to remove the soil, drums, debris, and contaminated soils at the T-1 site. Excavation equipment will consist of a track-mounted excavator, backhoe, and/or front-end loader. The excavator bucket will be equipped with brass, bronze, or equivalent teeth to minimize spark-potential while handling drums containing depleted uranium.

Drums will be removed from the excavation one-at-a-time in order to minimize exposure to workers, the public, and the environment. Standard fire prevention and suppression techniques for pyrophoric metals will be utilized. Extinguishing agents for the potentially pyrophoric depleted uranium chips will be located immediately adjacent to the excavation site and ready for use by trained personnel. Activities associated with excavation of T-1 include:

- Breaching intact drums in trench to relieve any pressure buildup
- Removal of soil, drums, and debris from trench,
- Screening soil for radiological activity and potential VOCs
- Segregating/stockpiling soil in preparation for packaging for offsite shipment or eventual backfill use
- Transporting drums to drum handling area for evaluation and segregation of drum contents
- Removing any contaminated soils and performing verification sampling.

Excavation of T-1 will be by rows across the width of the trench. A single row is expected to contain between 10 and 12 drums (5-6 drums across stacked two high). Because of the pyrophoric nature of depleted uranium chips, the number of drums that will be simultaneously uncovered and exposed will be minimized. At most a single row (12 drums) will be excavated and exposed prior to beginning the next row with no more than 6 of these drums outside the confines of the trench undergoing the sampling and inerting process.

2.4.2 Staging/Segregation/Disposition of Contaminated Materials and Soil

Drums containing waste materials (paper, wood, PPE, crushed drums or drum fragments, metal, rubber, plastic, etc.) will be evaluated and segregated accordingly. Liquids and sludge, if encountered, will be screened for radiological and VOC contamination and re-packaged if required. After container integrity is assured, the liquids will be stored within secondary containment until appropriately dispositioned. Uranium chips/turnings, debris containing uranium chips and uranium chips in a soil matrix will be transported to the sampling and inerting pad (SIP).

Radiologically contaminated soil above RFCA Tier I action levels, not intimately associated with the depleted uranium waste, will be excavated, treated for VOCs if necessary, and staged for disposal.

Materials that cannot be immediately identified will be repackaged, and sampled to identify the contents. Once the material is identified, it will be disposed of properly. Soils likely to be below RFCA Tier I action levels will be temporarily stored in a soil stockpile (SS). Activities associated with staging/segregation of excavated material include:

- Receipt of drums and other wastes to be segregated,
- Determining if drums are holding waste (liquids, solids, sludge),
- Removing contents from drums for disposition (using manual and automated techniques),
- Transferring liquids and sludge to appropriate containers, sampling, and managing for appropriate disposal,
- Transferring depleted uranium chips/turnings to the sampling and inerting pad area, and
- Managing remaining solids for appropriate disposal.

2.4.3 Inerting of Depleted Uranium Chips/Turnings

The inerting of depleted uranium chips/turnings has been subcontracted to the Starmet Corporation. Department of Transportation (DOT) accepted methods will be utilized to inert metal uranium chips/turnings and incidental radioactivity contaminated soils in preparation for offsite shipment.

If excavated depleted uranium drums have sufficient structural integrity, they will be loaded into 85-gallon DOT Type 7A specification overpack containers appropriate for pyrophoric Class 7 (radioactive) materials and inerted by covering with mineral oil. Any lathe coolant that is present will be pumped from intact drums prior to adding mineral oil. The over pack drum will then be sealed. Inerting the depleted uranium by adding mineral oil isolates the uranium from oxygen and moisture, rendering it stable and non-pyrophoric. If depleted uranium chips are commingled within a soil matrix, the material will be containerized in Type 7A large metal boxes. Additional dry soil will be added as required to the top of the container to exclude all oxygen that might potentially react with any metallic uranium in the soil. The soil serves three functions (1) it serves as a dispersant to reduce the average concentration of potentially pyrophoric material to levels that would not sustain a reaction, (2) it excludes air by occupying all of the space in the box, and (3) it functions as a heat transfer medium to insure that heat from any localized region of slow oxidation is dissipated.

After inerting and packaging the depleted uranium material, the Type 7A specification containers (85-gallon drums or large metal boxes) will then be temporarily stored at the packaged material staging area prior to loading the material for transport. This shipping concept is compliant with DOT 49 CFR Part 173.418 for pyrophoric Class 7 radioactive materials.

The inerting of depleted uranium chips/turnings will utilize "batch" mode processing with no more than the equivalent of six 55-gallon drums being processed at a time. Activities associated with the inerting of depleted uranium chips/turnings include:

- Receiving depleted uranium for inerting from the staging/segregation area,
- Manual and automated movement/handling of uranium chips/turnings utilizing "batch" mode processing,
- Inerting depleted uranium and packaging it in DOT Type 7A Specification containers appropriate for pyrophoric Class 7 (radioactive) materials in preparation for offsite shipment,

3.0 RADIOLOGICAL CONCERNS

It is estimated that up to 20,000 kg of DU is present in Trench-1. Based on data published in the Health Physics Manual of Good Practices for Uranium Facilities, EGG-2530-UC41, June 1988, isotopic abundance and activities are indicated in Table 1, *Isotopic Abundance and Activity of Depleted Uranium Contained in Trench 1*:

Table 1: Isotopic Abundance and Activity
of Depleted Uranium Contained in Trench 1

Isotope	Abundance	Activity (Ci)
U-238	99.75%	6.673
U-234	0.0005%	0.621
U-235	0.25%	0.108

The radiological concerns associated with the scope of work include:

- 1) Generation of airborne radioactivity / potential inhalation,
- 2) Spread of contamination to personnel, equipment and surrounding areas,
- 3) Shallow dose to skin, extremities and lens of the eye from handling DU debris and turnings.

Essentially all of the beta radiation field from DU comes from the progeny radionuclide Pa-234m and to a lesser extent Th-234. During melting and casting operations, these daughter elements may concentrate on the surfaces of the castings and equipment, producing surface beta radiation fields up to 20 rad/hr [Reference 3]. These levels are not anticipated during the T-1 project. The progeny that may have migrated to the surface during the melting and casting operations have long since decayed. This material may exhibit surface beta radiation levels typical of uranium metals and compounds, as indicated in the Table 2: *Beta Surface Dose Rates From Equilibrium Thickness of Uranium Metal and Compounds*:

Table 2: Beta Surface Dose Rates From Equilibrium
Thickness of Uranium Metal and Compounds

Source	Surface Dose Rate* (mrad/hr)
Natural Uranium metal slab	233
UO ₂	207
UF ₄	179
UO ₂ (NO ₃) ₂ ·6H ₂ O	111
UO ₃	204
U ₃ O ₈	203
UO ₂ F ₂	176
Na ₂ U ₂ O ₇	167

* Beta surface dose rate in air through a polystyrene filter 7 mg/cm² thick.

Through communications between Starmet Corporation, (subcontracted by Rocky Mountain Remediation Services to sample, inert, package and treat (at their off-site facility) the DU removed from T-1), and Radiological Engineering, the anticipated beta surface dose rate from DU metal turnings should range between 20 to 50 mrad/hr.

Surface beta/gamma dose rates were obtained on four 55 gallon drums containing depleted uranium chips and turnings in Building 444. Surface dose rates for each drum was 1.0 mrad/hr gamma. Gamma dose rates at 30 cm from 55 gallon drums of DU turnings obtained were less than the detection limit (0.5 mrad/hr) for the Eberline RO-20.

Based on the above data, a man-rem estimate will not be performed for this evolution. Based on data obtained during the Trench 3 and 4 and Mound Environmental Remediation Projects, RMRS budgeted 231 mrem for the Trench 1 Project for their Calendar Year 1998 ALARA Goals.

4.0 OPTIONS CONSIDERED

The options of Article 312.4 of the RFETS Radiological Control Manual and Section 17 of the ALARA Program Plan 94-ALARA PLAN-0003, have been evaluated in relation to the safe performance of this work and the following applicable options have been considered:

1. Use of engineering and administrative controls to minimize the spread of contamination and generation of airborne radioactivity.
2. Specification of special radiological training and monitoring requirements.
3. Staging and preparation of necessary materials and special tools.
4. Provisions for waste minimization and disposal.
5. Limiting environmental conditions that would curtail work activities.
6. Review of abnormal and emergency procedures and plans.
7. Personnel dosimetry and protective equipment requirements.
8. Appropriate radiological control hold points and work practice assessment.
9. Walk-down and dry-run of processes using applicable procedures.

5.0 CONTROLS TO BE IMPLEMENTED

Following the completion of the ACE, which included representatives from each work group associated with the Trench 1 Excavation Project, the following actions have been identified which will establish radiological controls in a manner that does not escalate the inherent hazards associated with this Project.

1. Use of engineering and administrative controls to minimize the spread of contamination and generation of airborne radioactivity.

Contamination / Airborne Radioactivity Control Techniques:

Excavation, segregation, and inerting activities will be conducted within a temporary structure shielding the work site from the elements, specifically wind and precipitation, thereby minimizing the potential for the spread of contamination outside of the work site.

Designated routes will be established to accommodate the transfer of excavated materials from the trench to the SIP and to the soil stockpile. These routes will be marked in a manner that distinguishes the areas from the surrounding areas enclosed within the tent. These transport routes will be surveyed for contamination on a routine basis and decontaminated as warranted.

Full-time RCT coverage will be required. Contamination surveys will be performed prior to, during, and at the completion of the work activities on personnel, equipment and surrounding areas as necessary. Radiological Operations Supervision and Radiological Engineering will determine the frequency for performing contamination surveys for the project.

Dust suppression in the form of water spray and ConCover will be employed during active excavation and during additions and removal of soils from the soil stockpile.

Radiological posting and deposting requirements will be performed in accordance with the Site Radiological Control Manual.

2. Specification of special radiological training and monitoring requirements.

Sampling / Monitoring Requirements:

Air sampling will be performed using high and low volume air samplers. Radon discrimination will be employed to accurately reflect job specific airborne radioactivity. Air sampling will be performed to give qualitative indications of changing radiological conditions and to verify that airborne radioactivity levels have not exceeded the level set forth below. During active excavation, air sampling as determined by Radiological Safety Supervisor will be performed as close as permissible to the excavation site. The placement of air monitoring equipment will be performed in accordance with 3-PRO-109-RSP-04.03 *Placement of Air Monitoring Equipment*.

A continuous air monitor (CAM) will be stationed within the tent ingress/egress vestibule to provide a method of alerting personnel to unexpected increases in airborne radioactivity levels. This CAM will be calibrated for U-238. The anticipated airborne radioactivity levels along with respiratory protection requirements alleviate the need for real time air monitoring within the main tent structure.

An enhanced ambient air monitoring program as detailed in the *Air Pollution Emission Notice (APEN) Report Trench 1, IHSS 108, Operable Unit No. 2*, will be conducted during T-1 remediation.

Training Requirements:

In addition to core radiological training, individuals assigned to this project will receive special radiological briefing in accordance with Article 662, *Uranium Facilities*, of the RFETS Radiological Control Manual.

Bioassay Requirements:

Pre and Post Bioassay for uranium will be required of all personnel specifically assigned to this project who routinely work within the Trench-1 Tent.

3. Staging and preparation of necessary materials and special tools.

Personnel, material and equipment requirements are described in Section 5.0, Health and Safety, of the Final Field Implementation Plan (FFIP) for the Source Removal of Trench 1 (IHSS 108) .

4. Provisions for waste minimization and disposal.

A Waste Management Plan is described in Section 9.0, Waste Management, of the FFIP.

The subcontractor will determine the feasibility of recycling DU. Recycling will occur at the subcontractor's off-site facility.

5. Limiting environmental conditions that would curtail work activities.

In an effort to minimize downtime due to adverse weather conditions, Project Management opted to perform the excavation, sampling and inerting and soil stockpiling within a single weather structure encompassing the work site. Environmental conditions that would curtail work would be those conditions that exceed the manufacturer's specifications for the structure and/or RFETS limitations for work inside temporary structures, as applicable.

6. Review of abnormal and emergency procedures and plans.

Actions required in abnormal and emergency conditions are to be covered with involved personnel during pre-evolutionary briefings.

Project specific spill response actions have been developed. Personnel involved with work inside the tent will be trained on these actions. Visitors to the tent will be briefed on these response actions prior to entry.

7. Personnel dosimetry and protective equipment requirements.

Dosimetry Requirements:

Whole body dosimetry will be required for all individuals entering the Trench-1 Tent.

Extremity monitoring will be required for all individuals handling debris and drums. Wrist dosimeters and/or finger dosimeters will be worn beneath the gloves and positioned so that the dosimeter window is directed in toward the palm. If radiological data indicates contact dose rates result in an insignificant dose to the extremities, Radiological Engineering will reevaluate the need for extremity monitoring. Controls to limit skin, extremity and lens of the eye dose are detailed below.

Skin, Extremity and Lens of the Eye Dose Reduction Methods:

ANSI approved safety glasses will be worn by individuals not wearing full-face respiratory protection to limit the beta dose to the lens of the eye and protect against industrial hazards.

Lead loaded (30 mil equivalent Pb) gloves and leather work gloves will reduce skin dose by a factor of 12 [Reference 3, Section 7.43]. Remote handling of debris and turnings will provide a significant dose reduction.

Contamination build-up inside reusable work gloves (leather) can lead to an unacceptable hand dose. Leather gloves that are to be reused will be routinely monitored, inside and out, for contamination build-up and will be disposed of when excessive levels of contamination are detected.

PPE Requirements are as follows:

Work inside a high contamination area (HCA): Double set of anti-contamination clothing (outer layer of TYVEK or equivalent). Consistent with Appendix 3 C of the Site RCM, individuals performing routine work, (light work), may work inside the HCA in a full set of anti-contamination clothing and a double set of gloves and shoe covers.

Work inside a contamination area (CA): Single set of anti-contamination clothing.

Individuals handling DU turnings, drums and debris will don in the following order: 2 pair of surgeons gloves (or equivalent) and lead loaded anti-contamination gloves. This requirement is intended only during the direct handling of turnings/debris, and may be downgraded based on actual survey data with Radiation Safety approval. Remote handling of debris, the preferred method, may be performed wearing two pair of anti-c gloves and leather gloves in lieu of lead loaded gloves. Surgeons gloves may be substituted for cotton liners.

Self-contained breathing apparatus or airline respirators will be worn by individuals during excavation. Respiratory protection prescribed for excavation is based on the chemical hazards associated with the operation of combustion engines within an enclosure and the potential to encounter unknown chemical contaminants. When the tent structure has been cleared from chemical contaminants, respiratory protection will be based on actual radiological conditions.

8. Appropriate radiological control hold points and work practice assessment.

The following suspension guides were derived based on a depleted uranium source term. Should work place indicators reveal the presence of additional radioisotopes in levels significant enough to warrant definitive radiological controls, this ALARA job review will require revision as well as any active radiological work permits governing Trench-1 remediation activities.

RWP Suspension Guide Limits (SGL):

Contamination level SGLs:

High Contamination Areas

A limit of 400,000 dpm/100cm² for removable beta contamination in high contamination areas. This value was derived to ensure airborne radioactivity levels do not exceed 0.1 of the U-238 (Class Y) DAC (based on a conservative resuspension factor of $1 \times 10^{-7} \text{m}^{-1}$).

A limit of 200,000 dpm/100cm² for removable alpha contamination in high contamination areas. This value was derived using an alpha to beta ratio of 1:2, characteristic of DU. Reference [3].

Contamination Areas

A limit of 100,000 dpm/100 cm² removable beta contamination limit is set for contamination areas, value obtained from Reference [1], Table 2-2.

A limit of 50,000 dpm/100 cm² removable alpha contamination limit is set for contamination areas, again this value was derived using the anticipated alpha to beta ratio.

Radiological control technicians should make note of the alpha to beta ratios present during contamination surveys. The approximate alpha:beta ratio for DU is 1:2. As U-235 is enriched, the specific alpha activity increases while the U-238 progeny beta activity decreases. For instance, the alpha:beta ratio at 10% U-235 enrichment is 12.5:2.0 (Reference [3], Table 5). Alpha:beta ratios outside of that predicted may be an indicator of enriched uranium or transuranics and will be investigated promptly if identified. If transuranic isotopes are confirmed, the RWP suspension guide limits will be revised to reflect the applicable limits.

Airborne Radioactivity Level SGL:

A limit of 10 DAC will be set when work is performed in supplied breathing air respiratory protection.

A limit of 10 DAC will be set when air purifying full-face respirators are worn.

A limit of 0.1 DAC when no respiratory protection is worn.

NOTE: DAC value based on U-238 Class Y (2×10^{-11} uCi/ml), Reference *10 CFR 835, Occupational Radiation Protection, Appendix A - Derived Air Concentrations (DAC) for Controlling Radiation Exposure to Workers at DOE Facilities*.

Radiation Exposure Rate SGL:

10 mrad/hr gamma at 30 cm from drum or debris, this limit will allow for continued operations and investigations should an anomaly be encountered while still adhering to the ALARA philosophy.

Attempts will be made to limit the general area dose rate to 2 mrad/hr.

Should dose rates in areas where materials accumulate such as at the SIP or staging area for radioactive material shipment exceed 5 mrem/hr then these localized areas will be controlled as radiation area and the dose rate of these areas will be limited to 10 mrem/hr.

300 mrad/hr beta on contact with drums or debris. This value is sufficiently above the maximum level identified in Table 2 *Beta Surface Dose Rates From Equilibrium Thickness of Uranium Metal and Compounds* to account for expected variations with radiation survey instrumentation and low enough to implement the ALARA philosophy.

Work in progress neutron surveys are not required based on source term. Neutron surveys will be performed on drums and debris that exceed the gamma radiation exposure rate SGL.

9. Walk-down and dry-run of processes using applicable procedures.

A walk down of the project work sequence and a dry-run of the processes at the excavation site is required. This is to ensure that problems are identified and resolved prior to excavating the trench soil.

Throughout the project, then Project Manager (or designee) and Radiation Safety Supervision shall routinely evaluate the effectiveness of ALARA work practices and modify work practices based on lessons learned as appropriate.

6.0 REFERENCES

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